

DOCUMENT RESUME

ED 232 975

SP 022 794

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TITLE Learning Styles: Their Effects on the Potential Development of the Brain.
PUB DATE [81]
NOTE 17p.
PUB TYPE Information Analyses (070) -- Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Cerebral Dominance; *Cognitive Style; Curriculum Development; Early Childhood Education; Educational Environment; Foreign Countries; Learning Modalities; Learning Theories; Neurological Organization; *Perceptual Development; *Schemata (Cognition); Teaching Methods
IDENTIFIERS Japan; United States

ABSTRACT

A review is presented of research findings on the operation and functions of the two hemispheres of the brain. In tracing discoveries on hemispheric specialization (the left processing information objectively, linguistically, and linearly; the right, spacially, intuitively, and creatively) the importance of achieving a balance between the differing abilities is pointed out. Examples are given of very early training of children in Russia, Uganda, and Japan which highlight the potential inherent in an environment which encourages the use of both brain hemispheres. It is suggested that given the fact that hemispheric asymmetry appears to be a common variation among children, curricula which address individual learning styles should be investigated. The feasibility of adjusting instruction to match cerebral dominance while incorporating activities for strengthening both hemispheres is discussed. (JD)

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Learning Styles: Their Effects on the Potential Development
of the Brain

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It is difficult to realize that only two hundred years ago the brain was thought by our forefathers to consist of a concoction of spirits which might be pure and tranquil, or riotous and evil. The gradual discovery that the central nervous system (C.N.S.) consisted of an immense universe of highly complex units has inevitably influenced man's conception of what he is, and how he should attempt to train the extra ordinary organization of Neurons with which he is endowed (Russell, 1956).

Gazzaniga (1977) in his early studies found that the Corpus Callosum, the Cerebral Commissure that interconnects the Left and Right half brains, was considered an enigma to neurologist and neurosurgeons in the 1940s and '50s. One of the most interesting recent research findings about the Human Brain is that its two hemispheres function differently in important ways (Gazzaniga, Wittrock, 1977).

The original experiments on the split brain were carried out on the cat by Ronald Meyers and Roger Sperry at the University of Chicago in the early '50s. The findings showed that the left hemisphere, as would have been predicted from early clinical reports, excelled in verbal processing of information of all kinds. The right hemisphere, however, proved superior in managing visual spatial tasks such as drawing cubes and arranging blocks to match a design (Gazzaniga, 1977).

One of the intriguing possibilities deriving from split brain research is the possibility that man can be explicitly specialized

in a variety of aspects of mental life: superiority in verbal area might not necessarily mean superiority in the visual-spatial area or vice versa (Gazzaniga, 1977). During the 1960's, extension of similar studies of human neurosurgical patients provided further information on the function of the corpus callosum and caused scientists to postulate a revised view of the relative capabilities of the halves of the human brain (Edwards, 1979).

Starting in the 1960's, Drs. Roger Sperry, Joseph Bogen, and Michael Gazzaniga of the California Institute of Technology greatly expanded scientific knowledge about this hemispheric specialization by research with patients whose traumatic epileptic seizures had been relieved by a radical surgery that severs the Corpus Callosum, the large bundle of nerve fibers that connects the left and right hemispheres of the brain. After recovery from surgery, so-called "split-brain" patients functioned surprisingly well except when confronted with situations like those devised by the Cal Tech researchers (Mckim, 1972).

Another researcher in this area (Wittrock, 1977) found that in man, the right cerebral hemisphere has long been referred to as the minor hemisphere. This is a reflection of the belief that, since language skills are organized primarily in the left hemisphere, it is this hemisphere that is dominant for most higher mental function. This view, however greatly under-estimates the importance of the cognitive operations carried out by the right hemisphere. As described by Nebes (1977), recent research findings have greatly changed previous conceptions of the right hemisphere and its function including how it

relies more on imagery than language and how it processes information synthetically rather than analytically. Therefore, it is important to realize how important it is to understand the function of the brain.

The main structure of the human brain, the cerebrum, is divided into two areas or hemisphere. Although the brain may be said to work as a whole, that is, response to stimuli involves the entire organism, there are certain mental activities which do emerge from certain brain areas (Schmuller, 1959). For example, scientific evidence of hemispheric specialization was first glimpsed over a century ago.

Early studies done by Nebes (Wittrock, 1977) on unilaterally brain-damaged patients showed two major class of cognitive deficits to be more prevalent after right than after left-hemispheric injury. These were (1) A difficulty in preceiving manipulating, and remembering the spatial relationship of objects, both to one another and to the patient himself; and (2) A difficulty in perceiving and remembering visual, tactile and auditory stimuli which are complex, fragmentary, or hard to label and describe verbally. Besides simple spatial interrelationships, other stimulus materials which right-hemispheric damaged patient have difficulty perceiving and remembering include faces, unfamiliar and complex shapes for which there are no ready names, drawing of objects in which part of the contour is missing, music and other non-verbal sounds.

By contrast, the left-hemisphere not only expresses itself in words but prefers to think "objectively" with symbols and abstract concepts. Krashen (Wittrock, 1977) found that the left cerebral hemisphere, at least in most people, processed language. The left

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hemisphere has also been shown to process both linguistic and non-linguistic information in characteristic ways: It is analyzed, linearly arranged, temporally ordered, and represented as propositions.

In this brief understanding of our hemispheric differences, Nebes (Wittrock, 1977) states that if the right hemisphere does indeed process data in a matter different from the left, we may be short changing ourselves when we educate only left-sided talents in basic schooling. This is especially true of the school systems in which our culture stresses left-hemisphere skills. Nebes also asserts that many problems can be solved either by analysis or synthesis; but if people are taught to habitually examine only one approach, their abilities to choose the most effective and efficient answer are diminished. Therefore one could conclude that Nebes increased understanding of how the minor hemisphere works will hopefully lead to better training in how to choose between training and to use the skills of both hemispheres of the human brain. Furthermore, Buck (Bronowski, 1965) states that Socrates, Plato, and Aristotle not only mastered the whole range of the learning of their times- something which is utterly impossible for the modern scholar or scientist to aspire towards- but they also bequeathed to us a concept that at least lives on in our conscience to taunt us with our failures in practice: The concept that the basic aim of education is so to educate the whole man that he becomes capable of living honourably in society and of contributing effectively to its functioning and governance. Buck also states that it is obvious that society gives its highest rewards and greatest recognition to the man who makes a

new discovery or successful application.

For a better understanding in the importance of this balancing the brain it is important that the educational researchers do not afford to remain isolated from neurology, neuropsychology, and related fields. The growing unity of interests across these different levels and fields promises to benefit all of them, to improve the quality of hypotheses studied in education and to improve the productivity and utility of the research studies in education.

Similarly, Parnes (1972) another researcher in the area states that failing to use mental resources is wasteful to both society and the individual. The person who fails to use his potential may become psychologically unhealthy or "mentally ill". He also states that the challenge of combining individuality with cooperation requires that in cultivating a person's full creative potential, we must be concerned with imagination developed, then disciplined. Development alone can actually be dangerous. Discipline with freedom is the key note, not discipline versus freedom, order out of disorder, not order versus disorder. It is important to begin to develop a person's mental potential at an early age.

Given that hemispheric asymmetry appears to be a common variation among children, it would seem that curricula which address individual learning styles should be investigated (Fadely and Hosler, 1979). Specifically, higher level, right hemisphere oriented curricula are recommended for those students whose strengths are in this area. For example, mathematics, architecture, art, music, and engineering re-

presents curricular areas well suited to the right hemisphere learner, who may excel in these areas despite reading and language problems. Unfortunately, as the curriculum is currently structured the self-confidence of these children is sometimes strongly impaired before they are afforded opportunities which foster their individual strengths. Therefore it is important to look at curriculum in a global manner.

We need to become aware of how people in other countries develop their potentiality through the use of both sides of the brain when it is developed. For example, educators in many other countries have likewise begun to recognize the value of early learning. Public education in Russia, for example, begins at the age of three rather than at five, and it is claimed that as a result, Russian children are, on the average, up to two years ahead of those in the West. However, a rich early environment can, though, be wasted if not properly followed through (Russell, 1979). Another example of early learning development is noted in the Ugandan culture.

At birth most babies, when held up with their feet on the floor, will begin to behave as if they were trying to walk. We in the West have a tendency to belittle this, believing that a child should not start walking until the age of 14 months or so. In Uganda, however, where mothers encourage this walking reflex, babies are found walking at seven to ten months. This is not a special characteristic of the race, for if a Ugandan baby is brought up in England, he generally does not walk until 14 months. Furthermore, at six weeks the Ugandan child is sitting up on his own with no support and participates actively with the world around him. At one year he is talking as well,

with a large vocabulary. The mother follows the infant in helping him with what ever he tries to do. Playing, grasping, and talking are all positively encouraged. It seems important to begin to see the value of early learning. Furthermore, it is quite possible, however, that the capacity to make good use of the brain depends largely on the chance of what patterns of activity were set up in the early months of life. Some researchers have found that enriched environments versus less enriched environment in early life has proved to be beneficial (Gebber, 1979 p. 185-195).

Kreck (1969) found that the brains of rats from the enriched environment had heavier and thicker cortices, better blood supplies, larger brain cells, and increased activity of two brain enzymes, acetylcholinesterase and cholinesterase, than did the brains of rats taken from the environment which did not have the same enriching elements. Furthermore, Schmuller (1956) reports that in general, psychologist now feel that intelligence is more amenable to change through environment than are such factors as language, abilities, interest, and aptitudes. In any case for most of us, with the possible exception of a genius, the more enriched the environment, the more likely our chances for real learning. Therefore, enriching the environments also enriches the brain.

In Japan, researchers such as the distinguished neurosurgeon Tsunoda (1978) believes that overemphases produce a lopsided mental function towards the left hemisphere of the brain. This results, Tsunoda maintains, in a dysfunction of the right hemisphere and an

inability to do intuitive and analogical thinking. Therefore, it is important to take a look at the curriculum where learning is developed, be that at home, at school, or in the classroom. In Japan, the most important aspect of the curriculum is the course of study (Schiller & Walberg, 1980).

The course of study in the Japanese elementary schools include Japanese language, social studies, arithmetic, science, music, arts, handicrafts, homemaking, and physical education. In junior high school it covers Japanese language, social studies, mathematics, science, music, fine arts, health and physical education, industrial arts, homemaking, and foreign language. The curriculum is quite comprehensive by American standards including political and moral issues, physical training the arts, vocational information, and world affairs as well as basic academic subject matter (Vogel, 1979). Torrance (1980) reports that tremendous importance is given in Japan to the preschool years, and creative skills and motivation are diligently and enthusiastically encouraged. Therefore, the right side of the brain is by no means neglected in Japan. Similarly, William K. Cumming, who has done the most thorough cross-cultural study of the Japanese and American elementary education comments as follows from his observations of music classes in Japanese schools:

By the sixth grade, most students are able to switch readily between at least three different instruments. The first time I saw this level of achievement I could not believe my eyes. But after the fifth primary

school, I had to recognize that it was widespread.

While members of the orchestras and bands in American primary schools achieve this level, most of the remaining students are musically illiterate. Comparisons in art are nearly as dramatic (Vogel, 1979).

The importance of such and enriched curriculum is necessary and it is important that educators realize how essential the role of an educational institution is to provide adequate nourishment so that the mind and spirit and character of man will grow in truth and beauty, and not atrophy unto death from lack of food (Buck, 1965). However, there seems to be no absolute methods of attaining a perfect remedy for proper nourishment.

As Wittrock (1981) reports that there are no panaceas for education in the recent research on the human brain. Neither are there any findings that indicate we should stop teaching culturally important skills or subject matter to any group of learners. On the contrary, when related to research in psychology and education, the research on the brain learning and the teaching of curricula and skills. Therefore, education must be such that it treats knowledge and practice as one. Education that lays, one-sided with emphasis on knowledge and lacks in practical application by the people is in contradiction to the true aim of our nation's education (Hall, 1949).

It is therefore important to maintain a balance in the learning curriculum. Wunderlich (1970) reports that it is very important that specialization for dominance be super-imposed on a practiced, smooth,

functional ability to use the two sides together for skilled acts that call for both sides. If dominance is obtained at the expense of two sided ability, harm may be done. Such a situation exists in the child who becomes dominant at too early an age or whose experiences are limited to one-sided activities after dominance is attained. It is therefore important to maintain brain balance by using it simultaneously in activities, thus nurturing it properly.

Wittrock (1981) reports in a less ambitious but more defensible sense of ideas worth thinking about, studies worth doing, and hypotheses about learning and teaching worth testing, there are important educational implication of the recent research on the human brain. Precisely because neuroscience, behavioral science, and educational research study different levels of related phenomena, research on the human brain can provide useful analogies, suggest new hypotheses, revise old theories and even eliminate some otherwise attractive but unproductive ideas about teaching and learning.

Languis, Sanders and Tipps (1980) have also made this observation: The acceptance of different ways of knowing (left and right hemisphere strategies) as legitimate methods of learning provides the first step towards building a balanced school program. Several studies by Languis, Sanders and Tipps (1980) indicated that greater achievement scores are obtained when both hemispheres are employed in curricula, utilizing not only the linear, verbal model we have touted so long but also active, motoric, image-rich visuo-spatial curricula models.

For example, if the teacher were to be made aware that a child is specialized in visual-spatial skills and the same conceptual problems are introduced, both the discouragement and the subsequent hostility might be avoided if the child is allowed to use his special talents. Conversely, the child with high verbal skills may quite frequently be unable to visualize the spatial aspect of an assigned task; in this case also, far better results could be obtained if he is not forced into academic areas for which he is not naturally equipped (Gazzaniga, 1977). As Wittrock (1981) reports the multi-variate reality constructed in the brain is more sophisticated and complicated than instruction is often design to accommodate. Maybe it is the two together (left-right brain) that serve to make the most truly useful representation of the world, partly map-like, partly abstract. Therefore, incorporating activities for strengthening both sides of the hemispheres, is absolutely essential.

Creativity learning requires more than technical skills and logical thought; it also needs the cultivation and collaboration of the appositional mind. If the constraint of an intellectual ideal can make man a unilateral being, physiologically underdeveloped, a better informed and foresighted community will strive toward a more harmonious development of the organism by assuring an appropriate training and a greater consideration for the other side of the brain (Bogen & Bogen, 1976).

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